REMARKS

Claim 20 was examined. Claims 1-19 are canceled. Claims 21-25 are added. Claims 20-25 remain in the Application.

The Patent Office rejects claim 20 under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 5,082,517 of Moslehi (Moslehi) in view of "Role of N_2 addition on CF_4/O_2 remote plasma chemical dry etching of polycrystalline silicon," Matsuo et al. (Matsuo).

Moslehi teaches preferably introducing both charged and neutral species into a processing chamber.

> Consequently, there is a need for a device that adjustably controls the plasma-generating electromagnetic power that a fabrication process receives to produce a process plasma consisting of activated charge and neutral species.

Col. 2, lines 37-41. The Patent Office believes that it would be obvious to combine Moslehi with the teachings of Matsuo to "optimize" the operation of Moslehi to provide a separation between chambers such that a separation is equivalent to a lifetime of nitrogen ions. In other words, the Patent Office believes an optimization of Moslehi is not to introduce both ions and neutral species as referred by Moslehi, but to introduce only neutral species. With respect to transferring the plasma radicals via a distance equivalent to the lifetime of nitrogen ions into the second chamber substantially free of the nitrogen ions, the Patent Office believes this is implicitly taught according to Figure 4 of Matsuo.

Figure 4 of Matsuo (shown below) shows the polycrystalline silicon etch rate versus a quartz-level transport tube between the plasma and the etch chamber. The inverted triangle in each case represents nitrogen addition to an etch chemistry of CF_4 or O_2/CF_4 to etch polycrystalline silicon. As clearly evident by each figure, where nitrogen is added, the etch rate is best at zero separation. The teaching of Figure 4 is that, with respect to etching, if nitrogen is to be used, there should be no separation between the applicator (plasma generator) and the etch chamber. In other words, no separation between chambers implicitly means that nitrogen ions and nitrogen radicals are preferably transferred into the etch chamber.

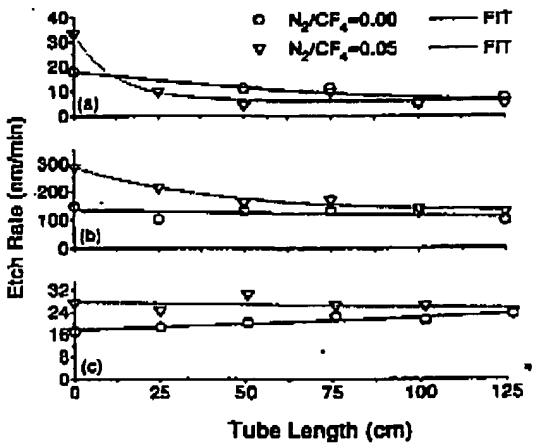

FIG. 4. Poly-Si etch rate vs quartz lined transport tube length. Panel (a) represents an O_2/CF_4 ratio of 0.00, (b) 0.15, and (c) 0.75.

Based upon the above analysis, the combined teachings of Moslehi and Matsuo are that any plasma from nitrogen transferred to a chamber should include both nitrogen ions and nitrogen radicals. There is no motivation to combine the references in a manner that would teach transferring plasma radicals via a distance equivalent to the lifetime of nitrogen ions into a chamber substantially free of the nitrogen ions. Applicants respectfully request that the Patent Office withdraw the rejection of claim 20 under 35 U.S.C. §103(a).

Claims 21-22 depend from claim 20 and therefore contain all the limitations of that claim. Claim 21 adds that a method performed by the digital processing system further comprises reacting the plasma radicals with a film on a substrate. Claim 22 adds that the reacting comprises converting a portion of the film into a nitrogen-containing material. Support for these amendments may be found in the Application at, for example, with reference to Figures 5-6 and the associated text as well Figures 1-2 and the accompanying text.

Matsuo describes the formation of a reaction layer (e.g., an SiO_xF_y reaction layer), but Matsuo does not describe nitrogen (either plasma or ion) specifically being incorporated into a reaction layer or reacting with a substrate in a film conversion step.

> Strong surface chemical changes are observed upon N_2 addition, although little nitrogen is incorporated in the reaction layer. The nitrogen is active only as a reactive intermediate. Depending on the O_2/CF_4 ratio, i.e., the predominance of F or O, either thinning or thickness growth of the modified surface layer can be seen.

Matsuo, page 1813 (does not say nitrogen is incorporated in a reaction layer or that nitrogen radicals react with a substrate in a film conversion step).

> Even though nitrogen plays a profound role in the etching of silicon, it is not incorporated in a stable reaction layer.

Matsuo, page 1806 (does not say nitrogen is incorporated in a reaction layer or that nitrogen radicals react with a substrate in a film conversion step). Matsuo at its core is directed to a known etching process of etching silicon with CF_4. Thus, the combination of Matsuo and Moslehi does not teach either claim 21 or claim 22.

Claim 23 describes a machine readable storage medium containing executable program instructions which when executed cause a digital processing a digital processing system to perform a method comprising generating a plasma from nitrogen comprising nitrogen radicals and nitrogen ions in a first chamber and transferring the plasma to a substrate site within a second chamber so that at the substrate site the plasma is substantially free of the nitrogen ions. Claim 24 describes reacting the plasma radicals with a film on a substrate and claim 25 describes reacting comprising converting a portion of the film into a nitrogen-containing material. Applicants believe the arguments presented above with respect to claims 20-22 are applicable to claims 23-25. Applicants respectfully request that the Patent Office enter claims 23-25.

CONCLUSION

In view of the foregoing, it is believed that all claims now pending patentably define the subject invention over the prior art of record and are in condition for allowance and such action is earnestly solicited at the earliest possible date.

Respectfully submitted,

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